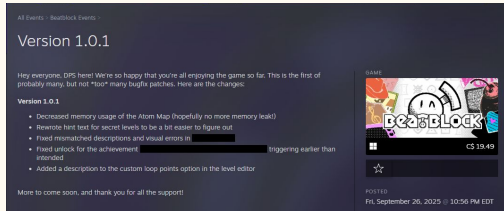


Patch Note Classification : PatchSense

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Under Dr. Cristiano Politowski

Motivation & Problems



Patch Note



Promotion

- No large-scale classified dataset exists, no searchable tool exists
- Understand developer update strategies
- Explore common bugs in games
- Patch notes and promotional posts live in the same API endpoint — no separation
- Steam: 145,622 games, 1.87M news items

Pipeline Overview

Data Collection

>

Keyword Filtering

>

LLM Classification

>

Web Application

01

raw_news/

145,622 Games
1,873,879 News Items

02

filtered_patches/

73,744 Games
1,085,168 Filtered Items

03

llm_filtered_patches/

68,043 Games
871,765 Patch Notes

04

SQLite + FastAPI

Created a web application making patch notes available, using search and filters

Stage 1 & 2: Collection + Keyword Filtering

1 : Collection

> GetAppList →
Appdetails →
GetNewsForApp

> 100K calls/day rate limit

> 145,622 games

> 1,873,879 news items

2 : Keyword Filtering

> Keywords:
"patch notes", "hotfix",
"changelog", "bug fix"

> High recall, lower precision

> 73,744 games

> 1,085,168 (57.8% retained)



**Stage 3: LLM
Classification**

3: LLM Classification

- Model: Gemini 2.5 Flash-Lite - [temp=0.0, response_mime_type=json]
- Three tasks :
 - Verify - is it a patch note?
 - Extract - find change statements
 - Classify - *bug / feature / balance_change*
- What is bug / feature / balance_change ? :
 - 'Fixed a crash when opening the scoreboard' : bug
 - 'Added three new playable heroes' : feature
 - 'Reduced cooldown 13s -> 10s' : balance_change

```
{
  "appId": "70",
  "count": 60,
  "notes": [
    {
      "title": "October 2, 2024 Update",
      "date": "2024-10-02 11:52:46",
      "url": "https://steamstore-a.akamaihd.net/news/externalpost/steam_community_announcements/63507290",
      "content": "[list]\n[*]Fixed HLTV startup crashes and incompatibility with 25th anniversary maps.\n",
      "key": "70::99a91e626f28fedf93dd210bdc6e593b60171704",
      "tags": [
        {
          "bug": "-Fixed HLTV startup crashes and incompatibility with 25th anniversary maps."
        },
        {
          "bug": "-Fixed memory leak that caused a crash after repeatedly changing brightness or gamma."
        },
        {
          "feature": "-Enabled /LARGEADDRESSAWARE to support mods with large memory requirements.."
        },
        {
          "bug": "-Miscellaneous mod compatibility fixes."
        },
        {
          "bug": "-Miscellaneous security fixes."
        }
      ]
    }
  ],
}
```

Classification by LLM

Batch vs. Sequential: Hybrid Architecture

- > Both ran simultaneously on non-overlapping file subsets
- > Unique keys enabled re-runs, allowing resume-from-failure
- > 50 concurrent in-flight jobs for batch processing
- > 200 sequential submission to avoid 429s

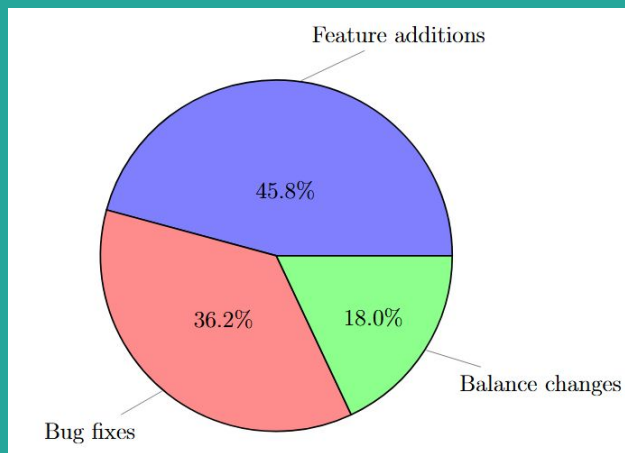
(Per-Call)	Sequential	Batch API
Cost	Higher	50% cheaper
Speed	Real-time	Hours
Scale	~200 patch notes	~10000 patch notes



Results

- 24.7% of keyword-filtered items were false positives (confirmed by LLM)
- Average 10.16 tags per note
- 57.7% of patch notes contain mixed change types

Pipeline Stage	Games	Patch notes
Raw News	145,622	1,873,879
Keyword Filtering	73,744	1,085,168
LLM Filtering	68,043	817,765



Stage 4: Web Application



PatchSense

BROWSE

- All Notes
- Bugs
- Features
- Balance Changes

Search patch notes... app_id game name Search Search within game

817,765 results | 68,043 games | page 1 of 48899

PHASE 2 COMPLETED [bug](#) [feature](#) [balance change](#)
app_id 3669698 | 3669698 | Sep 27, 2025

Updated to version 1.13 [bug](#)
app_id 2025688 | Universe Rea No Favorites | Sep 27, 2025

Jumping is here! [bug](#) [feature](#)
app_id 3064018 | 3064018 | Sep 27, 2025

Demo Version 0.7.2 - Patch Notes [bug](#) [feature](#) [balance change](#)
app_id 2202778 | 2202778 | Sep 27, 2025

Update v0.7.52 [09/27/2025] [bug](#) [feature](#)
app_id 3069988 | 3069988 | Sep 27, 2025

v2.4.7 Thicc Roccs Patch Notes [bug](#) [feature](#) [balance change](#)
app_id 572220 | MageQuit | Sep 27, 2025

EK Patch 8.1 - Patch Fixes [bug](#) [feature](#)
app_id 5688688 | Imperial Knights | Sep 27, 2025

Minor Patch - Alpha 1.9 [bug](#) [feature](#) [balance change](#)
app_id 3193818 | Christmas Is Coming | Sep 27, 2025

Version 1.0.1 [bug](#) [feature](#) [balance change](#)

Conclusion

- Largest classified patch note dataset: 817,765 patch notes, 8.3M tags, 68,043 games
- Two-stage pipeline solves the precision, cost and time tradeoff
- Hybrid batch+sequential architecture solved cost and speed at scale

Future Work

- Semantic clustering to find recurring bug patterns across games
- Analysis of game evolution studies
- RAG-based developer tool: "find how others fixed this bug"